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PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Group:	Unknown
Atty. Docket:	9090-0185
Applicants:	Lopatin et al.
Title:	ELECTROMECHANICAL DRIVE OR SENSOR ELEMENT FOR A MEASUREMENT INSTRUMENT, AND METHOD FOR THEIR PRODUCTION
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PRELIMINARY AMENDMENT

Commissioner for Patents
Washington, D.C. 20231

Dear Sir:

Preliminary to the examination of the above-identified patent application submitted herewith, applicant respectfully requests entry of the following amendment.

IN THE SPECIFICATION

At page 1, line 5, insert the heading, --FIELD OF THE INVENTION--.

At page 1, line 12, insert the heading, --BACKGROUND AND SUMMARY OF THE INVENTION--.

At page 6, at line 19 insert the heading, --DESCRIPTION OF THE DRAWINGS--.

At page 7, line 10, insert the heading, --DESCRIPTION OF THE PREFERRED EMBODIMENT--.

IN THE CLAIMS

Please amend claims 1-17 as follows:

1. (Amended) An electromechanical drive or sensor element having a layer structure, which comprises

- a plurality of piezoelectric ceramic layers [(12a-f; 22a-d; 41a-f)],
- an electrode layer [(16a-e; 26a-d)] which is arranged between two mutually facing surfaces of directly adjacent piezoelectric ceramic layers, and
- an electrical connector [(18a,b; 28a,b; 58a,b)] for making electrical contact with the electrode layer [(16a-e; 26a-d)],

-- in which case the connector [(18a,b; 28a,b; 58a,b)] is likewise arranged and is passed out between the two mutually facing surfaces of the piezoelectric ceramic layers [(12a-f; 22a-d; 41a-f)].

2. (Amended) An electromechanical drive or sensor element having a layer structure,

- having a plurality of piezoelectric ceramic layers [(12a-f; 22a-d; 41a-f)],
- in which mutually facing surfaces of directly adjacent piezoelectric ceramic layers [(12a-f; 22a-d; 41a-f)] are metallized by application of a metal coating,

-- which are joined together by means of diffusion welding,

-- so that an electrode layer [(16a-e; 26a-d)] is formed by the metallized surfaces,

--- with which contact can be made via an electrical connector[(18a,b; 28a,b; 58a,b)].

3. (Amended) The drive or sensor element as claimed in [one of claims 1 or 2] claim 1, in which a groove [14-a-d; 24a-d; 56a-f] is provided in at least one of the two mutually facing surfaces of the piezoelectric ceramic layers [12a-f; 22a-d; 41a-f] and at least partially holds the electrical connector [18a, b; 28a, b; 58a, b].

4. (Amended) The drive or sensor element as claimed in claim 3, in which the connector [(18a,b; 28a,b; 58a,b)] is a wire which extends beyond the surfaces of the piezoelectric ceramic layers [(12a-f; 22a-d; 41a-f)].

5. (Amended) The drive or sensor element as claimed in [one of claims 3 or 4] claim 3 having at least three piezoelectric ceramic layers [(12a-f; 22a-d; 41a-f)] and at least two grooves [(14a-d; 24a-d; 56a-f)], in which these grooves [(14a-d; 24a-d; 56a-f)] are arranged offset with respect to one another and with respect to a longitudinal axis [(29)] of the drive or sensor element.

6. (Amended) The drive or sensor element as claims [in one of claims 4 or 5] claim 4 which is in the form of a wire and is a wire having a rippled or zigzag structure.

7. (Amended) The drive or sensor element as claimed in [one of claims 1 to 6] claim 1 having piezoelectric ceramic layers [(12a-f; 22a-d; 41a-f)] composed of PZT material.

8. (Amended) The drive or sensor element as claimed in [one of claims 1 to 7] claim 1 having piezoelectric ceramic layers [(12a-f; 22a-d; 41a-f)] composed of $PbMg_{0.308}Nb_{0.617}Ti_{0.075}O_3$.

9. (Amended) The drive or sensor element as claimed in [one of claims 1 to 8] claim 1 having piezoelectric ceramic layers [(12a-f; 22a-d; 41a-f)] composed of a material having a Curie temperature of more than 400°C, for example composed of $Na_{0.5}Bi_{4.5}Ti_4O_{15}$ or Bi_3TiNbO_9.

10. (Amended) The drive or sensor element as claimed in [one of claims 1 to 9] claim 1 having electrode layers [(16a-e; 26a-d)] composed of a metallic material having a Curie temperature of more than 400°C.

11. (Amended) The drive or sensor element as claimed in [one of claims 1 to 10] claim 1 having electrode layers [(16a-e; 26a-d)] composed of bismuth-titanate.

12. (Amended) The drive or sensor element as claimed in [one of claims 4 to 11] claim 4 having connectors [(18a,b; 28a,b; 58a,b)] which are in the form of wires and are composed of a metallic material having high-temperature stability at more than 250°C.

13. (Amended) The drive or sensor element as claimed in [one of claims 4 to 11] claim 4 having connectors [(18a,b; 28a,b; 58a,b)] which are in the form of wires and are composed of a material which contains silver and contains stainless steel, or of such a material which contains a nickel alloy.

14. (Amended) A method for producing an electromechanical drive or sensor element having a layer structure, which comprises the following steps:

- production of ceramic layers [(12a-f; 22a-d; 41a-f)] composed of electrically active material using a method which is normal in ceramic technology, having desired dimensions and having a margin of 2-3 mm for each dimension taking account of the following mechanical machining;
- grinding the ceramic layers [(12a-f; 22a-d; 41a-f)] until a predetermined thickness of, for example, 0.15 to 03 mm [sic] is reached;
- cutting a groove [(14a-d; 24a-d; 56a-f)] in one faceof the ceramic layers [(12a-f; 22a-d; 14a-f)] which is to be metallized;

-- in which case the depth of the groove [(14a-d; 24a-d; 56a-f)] must be no deeper than half the thickness of the ceramic layer [(12a-f; 22a-d; 41a-f)] under consideration;

- coating at least one face of the ceramic layers [(12a-f; 22a-d; 41a-f)] with metal by applying a paste containing silver twice and subsequent heat treatment at a termperature of 800-820°C;

- applying adhesive to the metallized surfaces of two ceramic layers [(12a-f; 22a-d; 41a-f)] using cellulose adhesive;

- diffusion welding of the layers to which adhesive has been applied by heat treatment at a temperature of 780-800°C and single-axis compression at a pressure of 3-5 kg/cm^2 over a period of 3 hours and cooling to room temperature;

- drawing in each case one connector wire [(18a,b; 28a,b; 58a,b)] into a groove [(14a-d; 24a-d; 56a-f)];

- polarization of the drive or of the sensor element by the action of an electrical field on the wires [(18a,b; 28a,b; 58a,b)] at high temperature;

- connection of the same poles of the drive or of the sensor element;

- checking of the desired parameters and piezoelectric characteristics of the drive or of the sensor element.

15. (Amended) A level limit switch [(70)] having a drive and having a sensor element as claimed in [one of claims 1 to 14] claim 1.

16. (Amended) The level limit switch [(70)] as claimed in claim 15, in which the sensor element is separated from the drive by a non-polarized ceramic layer [(82d)].

17. (Amended) An acceleration sensor [(40)] having a sensor element as claimed in [claims 1 to 14] claim 1.

REMARKS

With the entry of the foregoing amendment, the application is believed to be in condition for allowance. Consideration of the claims leading to their allowance and passage of the application to issuance is respectfully requested.

Respectfully submitted,

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